CHEMICAL & ENGINEERING NEWS

C&EN

DECEMBER 20, 1993

MEETINGS CALENDAR; TOPICS AND DEADLINES FOR ACS MEETINGS PAGE 47

NITRIC OXIDE

Biochemistry's unexpected new superstar

Page 26

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CHEMICAL & ENGINEERING NEWS

C&EN

DECEMBER 20, 1993

NEWS OF THE WEEK

■ French scientists have found evidence of superconductivity at 250 K—86 K warmer than previously attained. **Page 4**

■ Job outlook for new grads in chemical sciences and engineering continues bleak, according to Northwestern University and Michigan State University surveys. **Page 5**

■ Researchers at Princeton's Plasma Physics Lab have produced a record 6 MW of controlled fusion power using the lab's Tokamak Fusion Test Reactor. **Page 5**

■ Eastman Chemical has received the U.S.'s top prize for excellence in quality management—the Malcolm Baldrige National Quality Award. **Page 6**

■ DuPont, Dow Chemical, and Northwestern University will team up to build and operate research facilities at the Advanced Photon Source nearing completion at Argonne National Lab. **Page 6**

■ New Greenland ice core data contradict theory that rapid global warming and cooling occurred during the previous interglacial period, the Eemian. **Page 7**

COVER: Artist's conception of nitric oxide biosynthesis

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BUSINESS

Global capital spending by major U.S. chemical firms will rebound next year following three down years; most outlays will go to process improvements and plant expansions. **Page 11**

GOVERNMENT

Congress' criticism of the Energy Department's handling of environmental cleanup was reinforced by a study showing overpayment, lack of control of independent contractors. **Page 15**

U.S. wet-scrubbing unit to reduce air pollution at Polish power plant is viewed as prototype of efforts by Department of Energy to help upgrade pollution control in Eastern Europe. **Page 17**

SCIENCE/TECHNOLOGY

Chem Show features new approaches for dealing with volatile organic compounds as increasing regulation of these emissions makes them a costly side effect of chemical processing. **Page 20**

BOOKS

In "Lifting the Veil: The Feminine Face of Science," author draws on Western culture, Taoism, and Jungian psychology to begin to integrate feminine aspects into male-dominated science. **Page 40**

MEETINGS

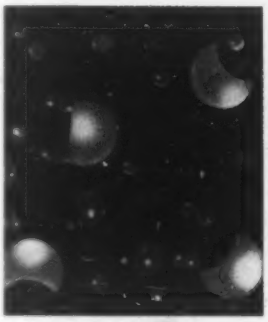
C&EN's semiannual calender lists scientific meetings and events scheduled through December 1994. **Page 47**

Topics of symposia and deadlines for submitting abstracts for ACS meetings in 1994 and later are listed. **Page 53**

ACS NEWS

ACS suggests several changes in Environmental Protection Agency proposed rule on hazardous waste disposal. **Page 65**

SPECIAL REPORT



Nitric oxide—a small, relatively unstable, and potentially toxic diatomic free-radical that does not contain carbon—appears to have messenger and effector roles in an astonishing range of physiologic processes, from neurotransmission to cytotoxicity. Page 26

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LETTERS

NAFTA bad for U.S. industry

Chemical Industry Medalist W. H. Clark (C&EN, Oct. 11, page 11) very forcefully endorses the North American Free Trade Agreement (NAFTA). His views, however, are parochial and do not represent the best interests of the U.S. as a whole. He has ignored, overlooked, or undervalued the vital interests of millions of blue-collar U.S. workers, and thousands of small U.S. businesses in textiles, metal tools, apparel, hardware, furniture, electric appliances, automotive parts and many other products. Many chemists are employed in these businesses.

He has totally disregarded any evaluation of environmental protection equity, comparative personnel safety, comparative environmental capital investment and operating costs (see C&EN, July 26, page 8), U.S. retraining, and environmental costs. Sen. Bob Kerrey (D.-Neb.), an advocate of NAFTA, admitted the Mexican agreement will cause loss of U.S. jobs and proposed a "strong federal commitment to job training."

Clark does not discuss the existing tremendous Mexican pollution of water, earth, air, and aquifers caused by present and past unsanitary Mexican municipal practices and by toxic contamination by petroleum operations and refining and industrial manufacturing [*Env. Sci. & Tech.*, **27**, 794 (1993)]

Industry in the U.S. cannot compete with industry in Mexico so long as Environmental Protection Agency, Occupational Safety & Health Administration, and Food & Drug Administration regulations are enforced in the U.S. but not in Mexico. U.S. companies operating in Mexico do not even obey the present weak Mexican environmental laws—a U.S. General Accounting Office survey of 12 such U.S. firms found that none bothered to comply.

Philip T. Gidley
President
Gidley Laboratories Inc.
Fairhaven, Mass.

First synthesis of nitrosyl azide

The news item "New oxides of bromine, nitrogen prepared" (C&EN, Nov. 29, page 51) moves me to write this letter. In the mid-1950s a group at the National Aeronautics & Space Administration's Lewis Research Center was speculating about how the next generation of hypersonic wind tunnels would be built. It would require high-mach-number air at very high stagnation temperatures. Prevalent practice favored ceramic blow-down tunnels. I proposed that nitrosyl azide would be an unstable analog of the nitrosyl halides and that its decomposition product would be virtually pure hot air. Used as a rocket monopropellant, it would provide, in the exhaust nozzle, a hypersonic high-temperature wind tunnel—a much better flight-condition simulator than anything else then being considered.

Accordingly, I asked a researcher in the section I headed, Harold W. Lucien, to attempt the preparation by a double displacement reaction using sodium azide and nitrosyl chloride. He explored several other synthetic routes as well. He produced a yellowish product with properties similar to those reported in the news item. In addition, he reported the results of difficult (because of explosions) measurements of a melting point range, the variation of vapor pressure with temperature, parts of the infrared spectrum, Trouton's constant, and other observations [*J. Am. Chem. Soc.*, **80**, 4458 (1958)]. If present measurements substantiate those of Lucien, and the substance is, indeed, nitrosyl azide, then its first synthesis should properly be attributed to him.

Lucien's work and my encouragement of it comes to mind now because recent interest in hypersonic flight has revived interest in hot wind tunnels. About a year ago, I asked one of my graduate students, Brian van Lear, to write a term paper on the use of nitrosyl azide for wind tunnels. It still looks like a pregnant idea. We are now writing a manuscript based in part on that paper.

Edward A. Fletcher
Professor of Mechanical Engineering
University of Minnesota, Minneapolis

Tea cannot improve memory

An article entitled "Natural product may be Alzheimer's therapeutic" (C&EN, Sept. 20, page 35) reported the research progress on the use of huperzine A in treatment of Alzheimer's disease. Indeed, huperzine A shows potential advantages over tacrine and physostigmine; it is longer lasting, less toxic, and more specific in its action. In clinical trials conducted in China, Alzheimer's and memory-impaired patients treated with huperzine A exhibited significant memory improvement.

However, drinking the tea of *Huperzia serrata*, a crude extract containing huperzine A, does not improve memory. The

Continued on page 79

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Chemical Capital Expenditures To Turn Up After Three-Year Decline

■ ***Hefty portion of rise will go to process improvements, expansion of existing plants in effort to reduce costs***

Marc S. Reisch,
C&EN Northeast News Bureau

Chemical companies expect that the U.S. economic recovery will finally mean improvements in sales and profit margins for them in 1994. As a result, many chemical producers plan to increase capital spending in 1994.

Total capital spending for a group of 18 chemical companies surveyed by C&EN is projected to rise in 1994 an average of 6% above that of 1993 to $6 billion, although individual companies' plans vary from no increase to a 50% increase, and few are even close to the average. In the survey, the same companies said plant and equipment spending this year declined 6% from last year to a total of $5.7 billion.

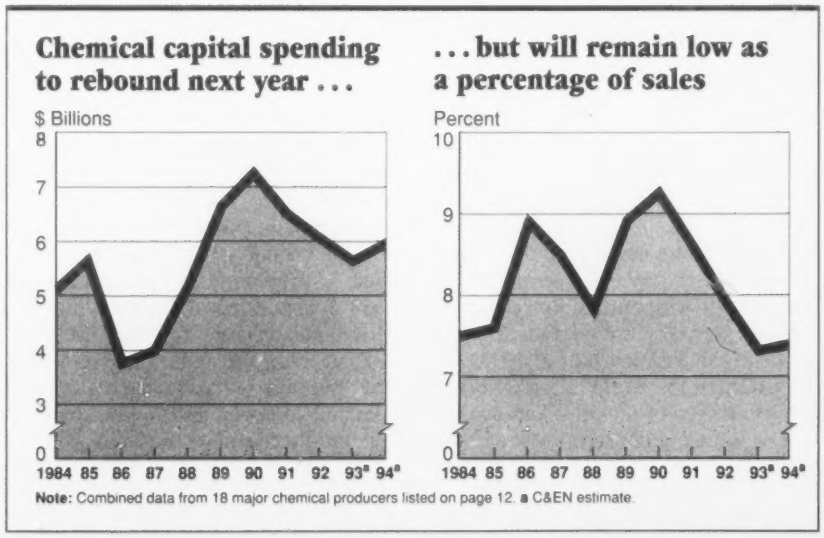
Cost control, though, is the industry byword—despite capital expenditures involving huge sums of money. Some companies will construct new plants, but the majority of chemical companies C&EN surveyed say they will continue to place major emphasis on process improvements and incremental expansions at existing plants in an effort to curb unit costs. In addition, continued expenditures on computers and operating software will allow companies to refine efforts to monitor plant processes, inventories, and customer orders, in another effort to curb costs.

Like last year, pollution abatement spending will characterize a hefty portion of capital expenditures. Although they cannot always justify such expenditures as cost-saving measures in the short term, companies must nonetheless comply with federal and state clean air and water mandates. From a legal standpoint, they must also limit their exposure to long-term pollution liabilities.

A survey of capital expenditures conducted among member companies by the Chemical Manufacturers Association (CMA) a few months ago and published this month, forecasts a 5% annual increase in chemical industry capital spending next year to $24.6 billion, based on 91 respondents. Although CMA's findings largely agree with C&EN's for 1994, the two surveys differ in their assessment of 1993 spending results. CMA estimates a 1.8% increase over 1992, based on 91 respondents, and C&EN estimates a 6% drop, based on 18 respondents. The discrepancy between the two surveys may be attributed to the timing of C&EN's survey compared with CMA's. Because C&EN conducted its survey earlier this month, companies may have a better estimate in hand for 1993 results than they did when CMA conducted its survey.

The CMA survey also found that pollution abatement spending will continue to rise. Over 16% of new capital expenditures, or nearly $4 billion went to pollution abatement control in 1993 and will continue to rise as a percentage of expenditures in 1994. These results, too, were in line with C&EN's survey.

Dow Chemical's light hydrocarbon plant under construction in Freeport, Tex., is slated to start up in first-quarter 1995.



Note: Combined data from 18 major chemical producers listed on page 12. a C&EN estimate.

Surveyed companies plan 6% capital spending jump in 1994

$ Millions	1994 Total	1994 U.S.	1993 Total	1993 U.S.	Worldwide 1993 planned[a]	Worldwide 1992	Worldwide 1991	Worldwide 1990	Worldwide 1989	% change 1994	% change 1993
Betz Laboratories	$ 60	$ 42	$ 70	$ 50	$ 80	$ 74	$ 58	$ 58	$ 53	–14%	–5%
Crompton & Knowles	20	na	15	na	15	13	11	16	13	33	15
Dow Chemical	1,400	800	1,500	950	1,800	1,595	1,908	2,119	1,756	–7	–6
Ethyl	230	na	210	na	300	157	166	152	119	10	34
Ferro	65	na	53	na	60	45	39	60	50	23	18
Hercules	165	83	165	74	193	150	215	273	293	0	10
Lubrizol	140	90	125	80	na	96	82	77	65	12	30
Monsanto[b]	510	350	470	330	na	586	591	750	607	9	–20
Morton International[c]	256	222	201	176	238	200	164	111	132	27	1
3M	1,200	745	1,200	745	1,326	1,318	1,326	1,275	1,137	0	–9
Nalco	135	85	120	81	140	131	137	115	86	13	–8
Occidental Chemical	180	na	160	na	150	258	234	318	412	13	–38
Olin	150	na	140	na	155	173	177	187	142	7	–19
Petrolite[d]	30	25	20	17	na	18	22	18	19	50	11
PPG Industries	400	230	330	161	400	283	335	567	671	21	17
Praxair	300	na	275	na	315	333	417	363	243	9	–17
Rohm and Haas	380	290	375	220	300	283	265	412	385	1	33
Union Carbide[e]	425	380	300	270	360	359	400	381	483	42	–16
TOTAL	$6,046		$5,729			$6,072	$6,547	$7,252	$6,666		
ANNUAL CHANGE[f]	6%	6%	–6%	0%	9%	–7%	–10%	9%	25%		

a Earliest estimate. b Figures for 1992 and 1993 exclude Fisher Controls, sold in October 1992. c Fiscal year ends June 30. d Fiscal year ends Oct. 31. e Figures restated to 1988 to reflect spin-off of Praxair in June 1992. f Cumulative changes for companies reporting. na = not available

According to economist Alexander Paris, of investment brokerage house Barrington Research Associates, Barrington, Ill., increased capital spending next year could result, at least in part, from global pricing trends. The slow European and Japanese economies are currently hurting raw materials producers such as chemical and metal companies, but he believes that as overseas economies pick up in the second half of 1994, capital budgets could start to rise significantly. He predicts that 1995 could be a "great year," with prices up and economies percolating. Capital budgets could increase significantly again.

Raw materials producers now lag behind in capital equipment outlays compared with U.S. industry as a whole, Paris says. In the first half of 1993, all industry capital equipment outlays rose nearly 20%, and continued to outstrip the 1992 investment pace. He says that spending on computer process controls for all industry also rose 20% in the first half of 1993. And he predicts the trend to retrofit with available state-of-the-art equipment using computer process controls will continue into 1994. Respondents to C&EN's survey also detailed some planned computer-related purchases.

This year's C&EN survey differs from last year's (C&EN, Dec. 21, 1992, page 9) because of the conspicuous absence of one major spender, DuPont, and four others. Although overall trends that the survey charts remain largely the same, the order of magnitude has changed: This year's total capital expenditures for reporting companies is lower by nearly $4 billion compared with the year-earlier survey.

An important fixture of annual surveys in the past, DuPont was unable to provide any data for either 1993 or 1994. It planned to spend nearly $2.8 billion in last year's survey of projected 1993 expenditures. Another big spender—American Cyanamid—was not included in this year's table because its chemicals business, Cytec, is about to be spun off to shareholders as a separate company. Not enough data exist to include an entry for Cytec alone. Last year, American Cyanamid planned 1993 expenditures of $420 million. International Flavors & Fragrances also was unable to respond in time for the survey, and so could not be included. It planned to spend $80 million in 1993. Air Products and W. R. Grace did not supply 1994 figures. Two companies are new to this year's survey—Lubrizol and Petrolite.

Of the 18 chemical producers who reveal 1994 plans, 14 expect to increase capital spending, two plan to hold spending to this year's levels, and two plan to decrease spending. Percentage-wise, Petrolite plans the largest increase—50% to $30 million, from a small base of $20 million. Expenditures include the construction of a new office building and production facilities expansions. Union Carbide plans a 42% increase to $425 million, Crompton & Knowles plans a 33% increase to $20 million, and Morton International plans a 27% increase to $256 million.

Other companies with plans for double-digit spending increases next year include Ferro, with a 23% increase to $65 million, and PPG Industries, with a 21% increase to $400 million. Nalco and Occidental Chemical both plan 13% increases to $135 million and $180 million, respectively. Lubrizol plans a 12% increase to $140 million, and Ethyl plans a 10% increase to $230 million. Ethyl plans to spin off its chemicals business to shareholders sometime early next year and supplied its spending figures on a pro forma basis. A spokesman for the company projects chemical capital spending alone for 1994 at $95 million, up 12% from this year.

Other firms planning smaller in-

European chemical giants to curb world capital spending, but boost it in U.S.

Six big European chemical companies—BASF, Bayer, Degussa, Hoechst, Lonza, and Rhône-Poulenc—forecast their capital expenditures worldwide will decline 5% in 1994 compared with spending levels in 1993, but their expenditures in the U.S. will rise 2%.

The recession still under way in Europe continues to hurt these large chemical companies, although, like their U.S. counterparts, they see a pickup in their North American business. Prospects for a recovery in Europe in 1994 are fair. So although the 18 U.S.-based companies that responded to C&EN's survey plan on average to increase their worldwide spending 6% in 1994, the European producers, with the bulk of their assets in Europe, plan a 5% drop in expenditures.

Of the six European-based producers, only one plans a significant cut in worldwide capital investments in 1994, one plans an increase, and four plan to maintain their expenditures in 1994 at the same level as in 1993. BASF plans the only cut in capital spending in 1994 compared with 1993, down 19% to a little less than $2.1 billion.

The four projecting the same global capital spending next year as this year are Bayer, which will spend $1.8 billion; Degussa, which will spend $294 million; Hoechst, which will spend $1.9 billion; and Lonza, which will spend $120 million. Only Rhône-Poulenc plans to increase its capital expenditures by 5% to $1 billion.

While these European chemical giants acknowledge a rather shaky European economic climate, as a group they recognize better immediate growth prospects in North America in 1994. Three plan to increase spending in the U.S., one plans no change, and two plan decreases. Lonza plans the largest increase, up 50%, to $30 million. The Switzerland-based company intends to expand its production capacities for hydantoin products in its Williamsport, Pa., facility. Bayer's U.S. company, Miles, plans the next largest increase, up 22% to $600 million. Degussa plans a more modest 9% increase to $75 million. Hoechst plans no increase in U.S. spending—it will spend the same $560 million on capital expenditures in 1994 as it spent in 1993.

Rhône-Poulenc plans to cut its North American expenditures 16% to $174 million. BASF plans a less severe cut in its U.S. and Canadian expenditures, down 13% to $400 million in 1994 compared with 1993.

The six Europe-based chemical companies spent 12% less worldwide in 1993 than they spent as a group in 1992. But in the U.S. market, as a group, these same six companies increased 1993 expenditures 19%. Though the recession was still quite severe in Europe during 1993, many of these chemical giants shifted capital resources to their U.S. operations, where economic recovery already had begun.

$ Millions[a]	1994 Total	1994 U.S.	1993 Total	1993 U.S.	% change worldwide 1994	% change worldwide 1993
BASF[b]	$2,059	$ 400	$2,529	$ 460	–19%	–8%
Bayer	1,824	600	1,824	490	0	–3
Degussa[c,d]	294	75	293	69	0	–22
Hoechst[c]	1,942	560	1,942	560	0	–11
Lonza	120	30	120	20	0	–16
Rhône-Poulenc[c]	1,000	174	948	206	5	–28
TOTAL	$7,239	$1,839	$7,656	$1,805		
ANNUAL CHANGE[e]	–5%	2%	–12%	19%		

a $1.00 = 1.7 deutsche marks, $1.00 = 1.5 Swiss francs, $1.00 = 5.8 French francs. b U.S. data includes Canada. c U.S. data includes Mexico and Canada. d Fiscal year ends Sept. 30. e Cumulative change for reporting companies.

creases include Monsanto and Praxair, both of which plan to increase capital spending 9% to $510 million and $300 million, respectively. Olin plans a 7% increase to $150 million, and Rohm and Haas plans only a 1% increase to $380 million. The two companies that plan to hold 1994 spending at 1993 levels are Hercules, which plans to spend $165 million, and 3M, which forecasts spending of $1.2 billion.

However, two companies plan to decrease capital spending next year. Betz Laboratories plans a 14% reduction to $60 million, and Dow Chemical plans a 7% cut to $1.4 billion.

For the group of 18 companies surveyed, C&EN estimates that combined capital spending as a percentage of sales will weigh in at 7.4% for 1994. That forecast is down from peak spending levels as a percentage of sales of 9.3% for reporting companies in 1990. The 1994 prediction is based on the assumption that capital spending will increase 6% for reporting companies. It also assumes a sales increase for the group of 4.5%.

For 1993, C&EN estimates that companies surveyed spent the same 7.3% of sales on plant improvements and equipment purchases as they may spend in 1994. That figure is based on the assumption that sales grew at only 1.5% for the group surveyed in 1993. It also accepts the survey's results showing that capital expenditures for the group of 18 companies declined 6% in 1993 compared with 1992.

This year's survey also predicts 1994 capital spending in the U.S. will increase at the same 6% pace as spending by responding companies worldwide. Nine companies plan to increase domestic spending, one plans to continue spending at the same pace as it did in 1993, and two plan spending decreases. Petrolite plans the largest spending increase, up 47% to $25 million on a small base, while PPG plans a sizable 43% increase to $230 million, and Union Carbide plans a 41% increase to $380 million.

Also planning large spending increases are Rohm and Haas, up 32% to $290 million; Morton International, up 26% to $222 million; and Lubrizol, up 13% to $90 million. Hercules plans a 12% increase to $83 million. Planning single-digit increases are Monsanto, up 6% to $350 million, and Nalco, up 5% to $85 million. Only 3M plans no spending increase, and will spend the same $745 million in 1994 as it did in 1993. The two companies that plan domestic decreases are Betz Laboratories, which will spend $42 million, down 16%, and Dow Chemical, which will spend $800 million, also down 16% from 1993. □